799

HICKOK

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OPERATING INSTRUCTIONS
for

DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

Mustang

MODEL 799

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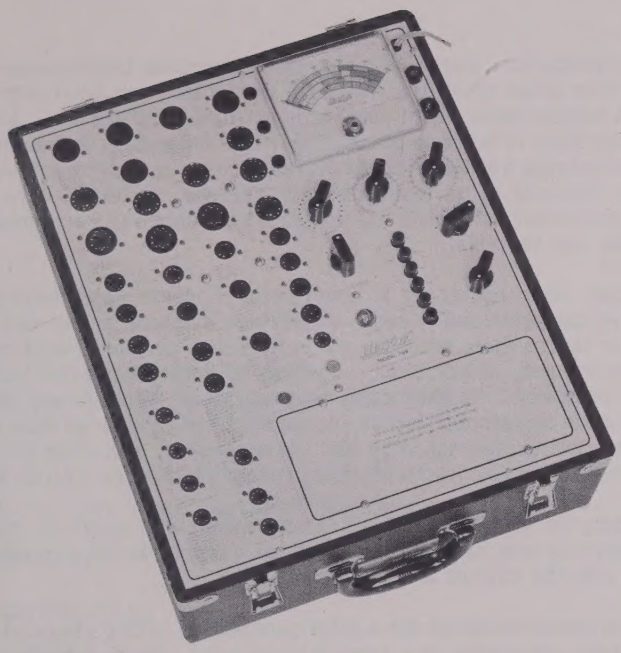
10514 DUPONT AVENUE • CLEVELAND, OHIO 44108 U.S.A.

2490-533



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DYNAMIC MUTUAL CONDUCTANCE TUBE TESTER

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THE HICKOK ELECTRICAL INSTRUMENT COMPANY
Cleveland, Ohio

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MEET YOUR "MUSTANG"

This is Hickok's Model 799, called the "Mustang" because of its modern features which incorporate SPEED into tube testing procedures. The multi-socket design eliminates time-consuming switching, and its solid state circuitry provides accuracy, reliability and light weight. As future tube types require more sockets, accessory assemblies will be made available for insertion into the panel to prevent obsolescence.

POWER REQUIREMENTS - 105-125 Volts, 50/60 cycles, 30 watts
WEIGHT - 19 lbs
SIZE - 19" x 15-1/2" x 6-1/4" deep
TUBE DATA - Data for all common tube types appears on the panel, as well as in the data booklet; booklet also includes data for the less common tubes.

CONTROLS AND CONNECTORS

The simplicity of operation of the Model 799 means the procedures for testing a tube will become routine to the operator after one time through the steps. Fig. 1 shows location of all controls and connectors, and they are explained in detail on page 5.

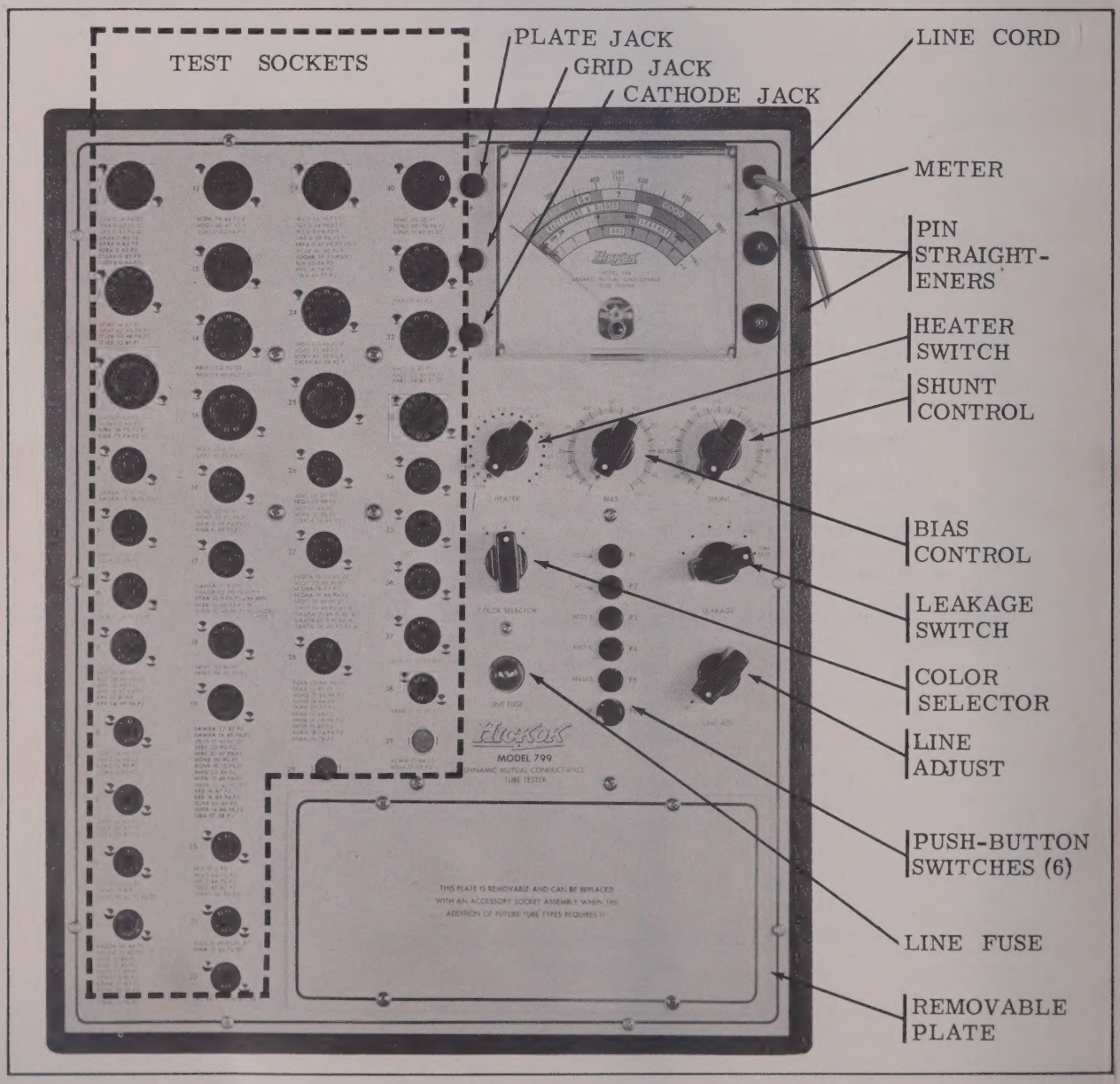

Figure 1. Controls and Connectors

TUBE SOCKETS - Min. 7, Min. 9, 10-pin Sylvania, Novar, Compactron, Octal, 5 and 7-pin Nuvistor and 10-pin Decal.

PLATE JACK - Connects plate of tube having top-cap connection to test circuitry.

GRID JACK - Connects grid of tube having top-cap connection to test circuitry.

CATHODE JACK - Connects cathode of tube having top-cap connection to test circuitry.

METER - Direct readout; indicates condition of tube in multi-colored scales; will detect as little as 1/10 μamp of grid current for gas test; measures inter-element leakage in terms of resistance up to 50 megohms.

PIN STRAIGHTENERS - Provide method of straightening pins for 7 and 9-pin tubes.

HEATER CONTROL - Provides voltage settings in 19 steps from 0 to 117 volts.

SHUNT CONTROL - Continuously variable, provides Gm range control: low, 1,000 to 5,000 μmhos; high, 5,000 to 20,000 μmhos.

BIAS CONTROL - Continuously variable, provides proper Grid BIAS.

LEAKAGE SWITCH - Provides connections for measuring inter-element leakage and testing for presence of gas. Also provides a TUBE TEST position to establish Gm circuitry.

COLOR SELECTOR - Three-position switch provides for re-arrangement of test socket receptacles for extended tube base coverage.

LINE ADJ - Continuously variable control to standardize line voltage and tube test potentials.

PUSH-BUTTON SWITCHES -

P1 - provides low Gm range
P2 - provides high Gm range
P3 - provides power rectifier tests
P4 - provides high-voltage rectifier tests
P5 - provides voltage for diode tests
P6 - provides selection of elements of second section of tubes, such as the 12AT7

LINE FUSE - Safety device for protection of tester as well as tube under test.

REMOVABLE PLATE - Your protection against obsolescence. This plate can be replaced by an accessory socket assembly when addition of future tube types requires new sockets. Also, CALIBRATION CONTROLS ARE LOCATED BENEATH THIS PLATE.

MAKING THE SET-UP

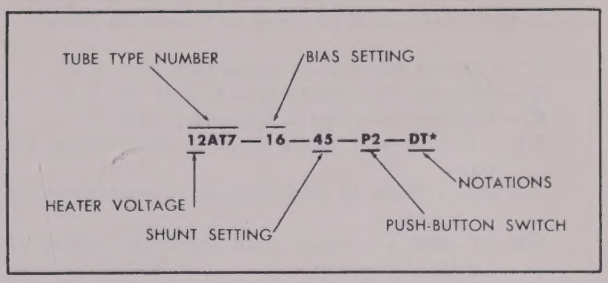

Figure 2. Explanation of Typical Tube Data Line

1. Select the socket on the panel which corresponds to the type number of the tube to be tested (see Fig. 2). DO NOT INSERT THE TUBE AT THIS TIME. The common tube types appear on the panel and additional types appear in the Tube Test Data Book.

2. Rotate the COLOR SELECTOR to match the color of the printing of the tube data line you are using; e.g., if data is in red, turn switch to R, if in green, turn to G, etc. If you get your data from the Data Book, the data line includes either an R, G, or B to indicate COLOR SELECTOR SETTING.

3. All numbers appearing before the first letter of the tube type indicate the nominal heater voltage for the tube to be tested. In the example of Fig. 2, the nominal heater voltage is 12; therefore, the HEATER control should be rotated until the knob points to the number closest to 12. In this case, it is 12.6.

4. Set the LINE ADJ (adjust) control to the OFF position.

5. Place the LEAKAGE switch on the TUBE TEST position.

6. If PUSH-BUTTON switch is indicated as P6 in tube data line, DEPRESS AND LOCK IT DOWN.

NOW YOU CAN TEST THE TUBE

1. Insert the tube into the socket directly above the data line corresponding to the tube type number. In the example of Fig. 2 it is socket #27.

2. Slowly rotate the LINE ADJ CONTROL clockwise until the meter reads at LINE TEST on its dial.

3. Check for letter combinations or symbols at the end of the tube data line being used. In figure 2, for example, the notation is DT. Following is an explanation of the notations to be found on tube data lines:

P - Connect tube cap to plate jack P
G - Connect tube cap to grid jack G
K - Connect tube cap to cathode jack K
DT - Repeat test while holding push-button P6 down
350 MIN - Tube is satisfactory if reading is 350 or more
SHORT POS 1 - Good tube indicates short on LEAKAGE position 1
HTR-1.4V - Set HEATER switch to 1.4 volts.
* - Disregard short on LEAKAGE position 3.
! - Make leakage test with HEATER switch OFF.
★ - Disregard GAS test.

4. Rotate the LEAKAGE switch through each of its four positions, pausing at each to check the meter reading. If the pointer is in the red area of the leakage scale at any time, discard the tube unless the notation on the data line allows a LEAKAGE exception for the tube under test. Now return the LEAKAGE switch to TUBE TEST position.

When testing tubes marked with an asterisk (*) in SOCKET 27, make the normal test, but disregard leakage indication in switch position 3. Then make heater-cathode leakage test as follows: 1) Color Selector to Blue; 2) Leakage switch to position #3; 3) P6 switch UP. Meter deflection under these conditions indicates heater-to-cathode leakage, BUT ONLY FOR SOCKET 27 TESTS OF TUBES MARKED WITH AN ASTERISK.

NOTE: Heater-cathode leakage is measured in position 3 of the leakage switch. Heater-cathode leakage current is read on the meter with full scale being 500 μamps. Any tubes registering in red or yellow areas in the leakage scale should be discarded. Here are maximum permissible heater-cathode currents.

Tube Types		Maximum Permissible Heater-Cathode Currents
Amplifier Tubes		
Plate Current:	0-20 ma	20 μamp
	20-50 ma	50 μamp
	50-100 ma	100 μamp
Horizontal Deflection Amplifier		100 μamp
Damper Diodes		10 μamp

5. BIAS setting is the number following the tube type number in the data line (see Fig. 2 for example) and SHUNT setting is the number after bias. Rotate these BIAS and SHUNT control knobs to the indicated settings.

6. The next number in the data line, prefixed by a P, indicates push-button switch to be used. Press the button indicated and read mutual conductance (quality) of the tube on the top colored scale. Red areas indicate the tube is faulty, yellow areas indicate questionable quality, green areas indicate acceptable quality.

7. To make a gas test on amplifier tubes (the tubes which require pushbuttons P1 or P2) repeat Step 6 and, while holding down push button indicated on the data line, rotate the leakage switch to the GAS position. The gas content of the tube is read on the bottom scale of the meter marked "GAS".

8. Return push-button switch P6 to its normal position.

NOTE: If more than one tube data line appears opposite a tube type, repeat the above steps for each data line.

MAXIMUM PERMISSIBLE GRID CURRENT

Because of the many and varied applications in which a given tube may be used, it is neither possible nor practical to establish a hard and fast limit for maximum permissible grid current. A certain grid current in a certain tube may be entirely satisfactory in one application and entirely unsatisfactory in another. For example, in an IF strip with a common AGC circuit, the individual grid currents may not be excessive, yet due to the common AGC, the total of the individual grid currents may be great enough to seriously impair circuit function. Thus, experience is the best guide. Figure 3 provides a general guide for maximum permissible grid currents based on typical applications.

SUPPLEMENTARY TUBE DATA

Regular supplementary data service is available through your Hickok distributor or by writing directly to the factory: 10514 Dupont Ave., Cleveland, Ohio, 44108. These same sources can provide you with the latest information on availability of future accessory socket assemblies.

LOW LEVEL AF TRIODE AMPLIFIERS	MAX. PERMISSIBLE GRID CURRENT
6AT6	0.5 μa
12AT6	0.5 μa
6AV6	0.5 μa
12AV6	0.5 μa
12AX7	1 μa

LOW LEVEL RF TRIODE AMPLIFIERS	MAX. PERMISSIBLE GRID CURRENT
6BC8	1 μa
6BQ7	1 μa
6BS8	1 μa
6BZ7	1 μa
6DJ8	1 μa
6J6	2 μa

PENTODE AMPLIFIERS	MAX. PERMISSIBLE GRID CURRENT
6AU6	1 μa
6BA6	1 μa
6BC5	1.5 μa
6BH6	1 μa
6CB6	1.5 μa
6BZ6	1.5 μa
6CF6	1.5 μa
6DE6	1.5 μa
6DK6	1.5 μa
6EW6	1.5 μa

GENERAL PURPOSE TRIODES	MAX. PERMISSIBLE GRID CURRENT
6C4	1.5 μa
6CG7	2 μa
6S4	2.5 μa
6SN7	2 μa

POWER PENTODES	MAX. PERMISSIBLE GRID CURRENT
6CA5	1.5 μa
6AQ5	2 μa
6CL6	3 μa
6CM6	2 μa
6CU5	2 μa
50C5	2 μa
6EM5	3 μa
6L6	3 μa
6BG6	4 μa
6CD6	5 μa
6DQ6	4.5 μa

Figure 3. Maximum Permissible Grid Current of Typical Tubes

The Model 799 has a unique switching system which reduces immeasurably the amount of switching necessary to completely test a tube in all its phases. See schematic wiring diagram in back of this manual. By use of appropriate push-button switches the various sensing circuits are actuated. For simplicity, the sensing circuitry of each test is considered separately.

DYNAMIC MUTUAL CONDUCTANCE TEST CIRCUIT

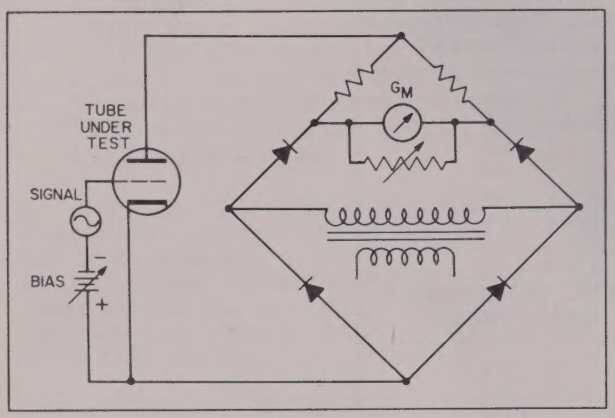

Figure 4. Simplified Mutual Conductance Test Circuit

Mutual conductance (also called transconductance) is defined as the ratio of a small change in plate current to a small change in grid voltage causing it. Its symbol is Gm and it is the figure of merit of a vacuum tube. Thus, if the plate of a tube is fed from a full wave supply (diodes CR-3, -4, -5, and -6 in the schematic wiring diagram) and an ac signal of the same frequency is inserted into the grid circuit, the current during one half cycle will be greater than the current during the other half cycle. If the grid signal is maintained at a low level, the Gm of the tube under test will be directly proportional to the difference between the two plate currents. This difference between the two currents is detected by the meter in conjunction with the two Gm sensing resistors and the shunt control. See figure 4.

GAS TEST CIRCUIT

A common method of detecting the presence of gas in a vacuum tube has been to insert a high resistance into the grid lead so that the grid current flowing due to the presence of gas, will cause a voltage drop across the resistance; thus subtracting from the bias and causing the plate current to increase.

Therefore, in the Model 799 the grid current (and hence the presence of gas) is detected by a transistorized amplifier in series with the bias supply while rated plate current is flowing. During testing, the grid current is directly readable on the GAS scale of the meter. Sensitivity is 10 μamp full scale and meter may be read to about 0.1 μamp. See figure 5.

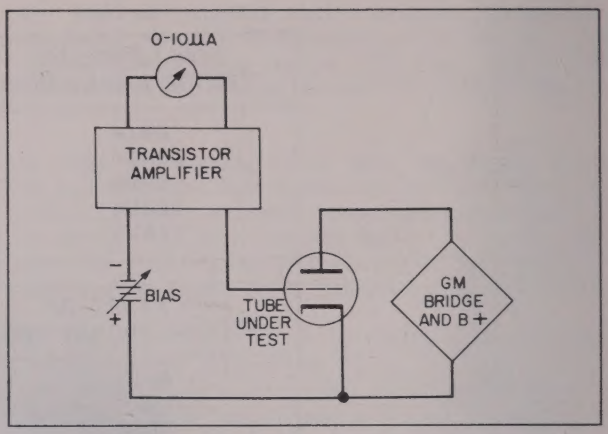

Figure 5. Simplified Gas Test Circuit

DUAL TEST CIRCUIT

The dual test push-button switch (DT - P6) facilitates testing of tubes with identical sections in the same envelope. Due to the multiplicity of sockets and the many connections on each socket, it is not practical to graphically portray a simplified dual test circuit. For specific information, refer to the schematic wiring diagram in the back of this manual

LEAKAGE TEST CIRCUIT

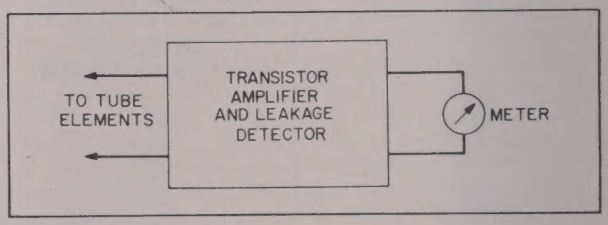

Figure 6. Simplified Leakage Test Circuit

The leakage test circuit is basically a transistorized ohmmeter which is switched between the various tube elements of the tube being tested by means of the LEAKAGE switch. The transistor drives the meter to full scale with a direct short. The design provides a safe inter-element test voltage for all tubes and avoids possible "poisoning" of grids due to a high test voltage. See figure 6.

DETECTOR DIODE TEST CIRCUIT

Detector diodes are usually rated in tube manuals on a basis of dc current rather than the ac voltages as in testing power rectifiers. Therefore, detector diodes are tested for their emission qualities while a dc voltage is applied in a test circuit as shown in figure 7, page 9.

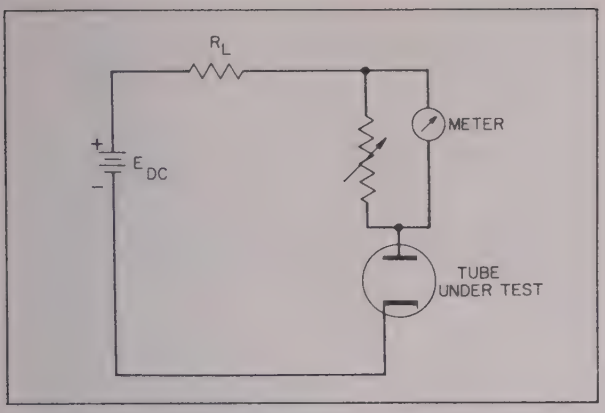

Figure 7. Simplified Detector Diode Test Circuit

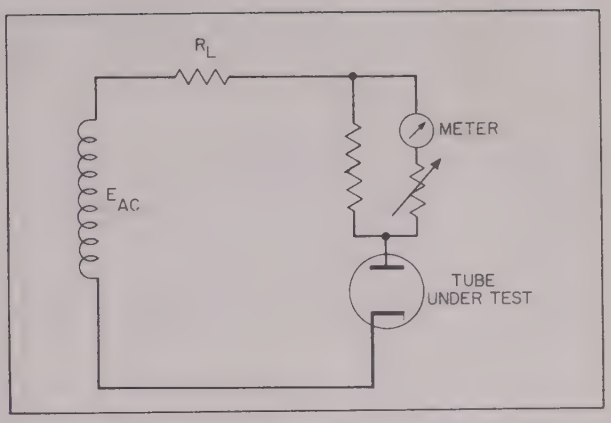

Figure 8. Simplified Power Rectifier Test Circuit

POWER RECTIFIER TEST CIRCUIT

Power rectifiers are employed to convert an ac voltage into a dc voltage. The emission properties of a power rectifier are an indication of the efficiency with which the tube can convert an ac voltage into a dc voltage. The test circuit as shown in figure 8 checks the emission characteristics of power rectifiers under simulated conditions encountered in actual operation of a tube.

MAINTENANCE

The Model 799 Mutual Conductance Tube Tester is built in accordance with sound engineering principles, by skilled personnel, using quality components. It should give years of trouble-free service. However, if service is required, it is suggested that the factory be contacted with regard to the nature of the trouble, and if necessary, the unit be returned to the factory or an authorized Hickok repair station for inspection and service.

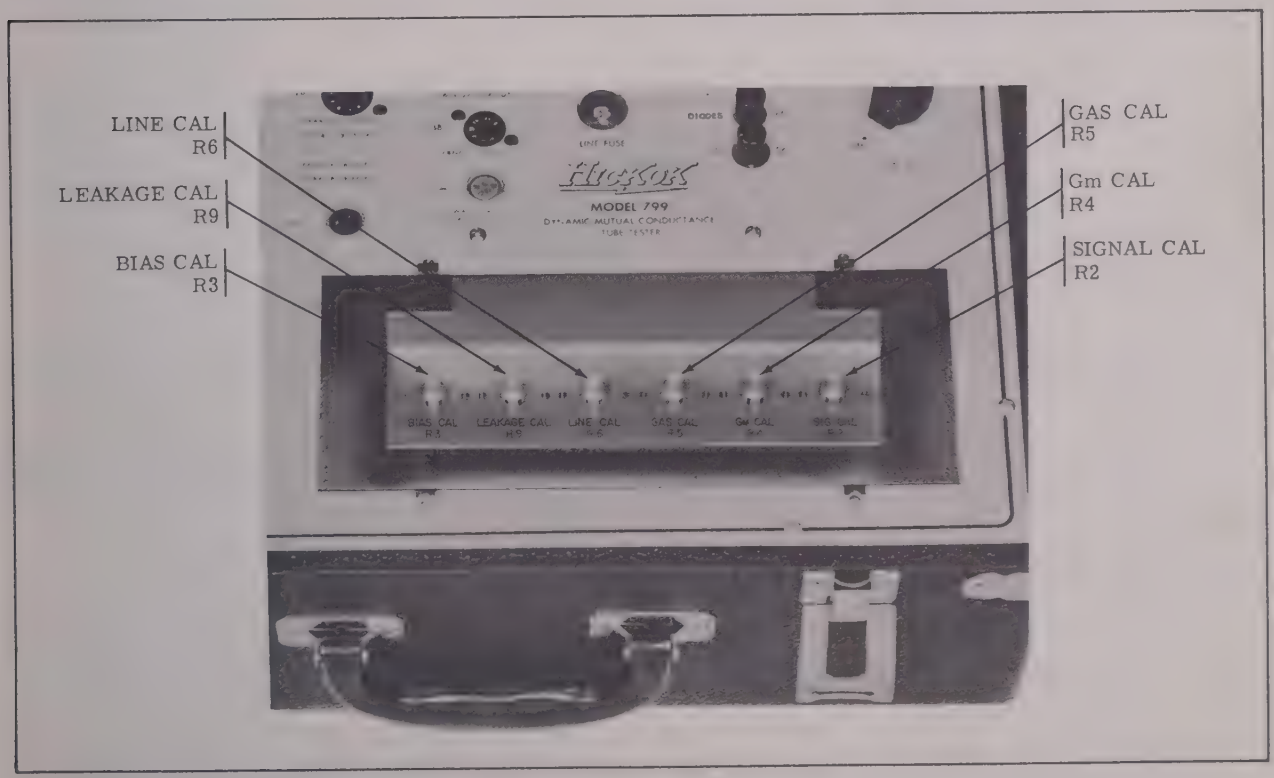

Figure 9. Calibration Controls

All calibration controls are located beneath the cover plate on the panel of the unit. It is only necessary to remove four screws. It is not necessary to remove the instrument from its case. See figure 9.

It is important that LEAKAGE, LINE ADJ, and GAS controls be re-adjusted every time the BIAS supply is re-calibrated as there is interaction between these adjustments. The following equipment is required for calibration.

a. AC-DC VTVM - Accuracy of ±1% or better is required - 100 volt dc range, 2.0 volt and 100 volt ac ranges.

b. DC microammeter, 0-10 microamps range.

c. Resistor, 1 meg, ±5%, 1/2 watt.

d. Resistor, 1K, ±5%, 10 watts.

LINE TEST AND BIAS CALIBRATION

To adjust the line test and bias circuits, proceed as follows:

a. Set HEATER switch to the .6 position.

b. Connect the AC VTVM between plate (P) and cathode (K) jacks on the front panel.

c. Depress and hold down push-button P3, while performing the next step.

d. Set LINE ADJ control for a reading of 36.5 volts RMS on the AC VTVM.

e. Release the push-button P3.

f. Disconnect the AC VTVM.

g. Connect the DC VTVM between grid (G) and cathode (K) jacks on the panel. Plus (+) to cathode (K), minus (-) to grid (G).

h. Set the BIAS control to 100; press and hold down push-button P1.

i. Adjust BIAS CAL R3 (figure 9) for a 50 volt reading on the DC VTVM.

j. Release the push-button P1.

k. Adjust LINE CAL R6 (figure 9) for a half-scale reading (LINE TEST) mark on the meter of Model 799.

GAS TEST CALIBRATION

To adjust the gas test circuit, proceed as follows:

a. Set the LEAKAGE switch to TUBE TEST position.

b. Check the line voltage. If the pointer of the Model 799 meter does not point to LINE TEST position, adjust to this position by means of the LINE ADJ control.

c. Set LEAKAGE switch to GAS position.

d. Set BIAS control to 0 (zero).

e. Connect the DC microammeter between the grid (G) and cathode (K) jacks on the panel with the 1 meg, ±5%, 1/2 watt resistor in series with the DC microammeter. Press and hold down push-button P1 and adjust BIAS control on front panel of Model 799 for a 10 microamperes reading on the DC microammeter.

f. Adjust GAS CAL - R5 (figure 9) for a full scale reading on the Model 799 meter. If full scale reading cannot be obtained, set for highest possible reading. This highest possible reading (but under 1000 on the meter scale) is satisfactory. A slight variation at this point is not critical.

LEAKAGE CALIBRATION

Leakage calibration can only be made AFTER the bias and gas calibrations have been made. To calibrate the leakage circuit, proceed as follows:

a. Set LEAKAGE switch to position 2.

b. Connect a jumper between the grid (G) and the cathode (K) jacks on the front panel.

c. Adjust LEAKAGE CAL - R9 (figure 9) for a full scale reading on the Model 799 meter.

d. Return LEAKAGE switch to TEST position.

SIGNAL CALIBRATION

To calibrate the signal circuit, proceed as follows:

a. Check the line voltage. If the pointer of the Model 799 meter does not point to LINE TEST position, adjust to this position by means of the LINE ADJ control.

b. Set the BIAS control to 0 (zero).

c. Connect the AC VTVM between the grid (G) and the cathode (K) jacks on the front panel. Meter ground to cathode jack (K).

d. Press and hold down push-button P1 and adjust SIG CAL - R2 (figure 9) for a reading of 2.5 volts (RMS) on the AC VTVM.

Gm BALANCE CALIBRATION

a. Set SHUNT control to 0 (zero).

b. Connect a 1K, ±5%, 10 watt resistor between the plate (P) and the cathode (K) jacks on the front panel.

c. Press and hold down push-button P2 and adjust Gm CAL - R4 (figure 9) for a 0 (zero) meter reading on the Model 799 meter.

ADDENDUM SHEET

Model 799 Tube Tester

Due to printer's errors, it was necessary that we ship the first few Instruction Manuals with the following inaccuracies in them. Please make the changes listed below:

Page 10 - LINE TEST AND BIAS CALIBRATION Paragraph g, add the following:

"(Press P2)" after "Set BIAS control to 100."

Page 10 LEAKAGE CALIBRATION Paragraph c, add the following:

"(Return LEAKAGE switch to TUBE TEST position)" at end of para. c.

Page 11 PARTS LIST

Change price on R2, RESISTOR, VARIABLE, from $5.50 to 51 cents.

Change price on R4, RESISTOR, VARIABLE, from $4.25 to 90 cents.

Change price on R6, RESISTOR, VARIABLE, from $2.50 to $1.28

Modification to Prevent Off-Scale Readings of 1B3 Tubes on the Model 799 Tube Tester

CIRCUIT DESCRIPTION

The clamping action of a silicon diode is employed which starts to take effect when the Model 799 meter deflects approximately 60% of full scale. At this point the voltage across the diode is just large enough for minimum conduction and shunting action. If the current through the meter increases the shunting action of the diode becomes more pronounced and more current is bypassed. The circuit was specifically designed so that the diode bypasses approximately 15% of the unshunted full scale current.

PROCEDURE:

Prior to the circuit modification, test a 6X4 tube and determine a SHUNT setting necessary on the tester to provide a full scale deflection on the Model 799 meter. Record this shunt setting and set the tube aside until the following steps have been carefully completed.

1. Remove the short black wire connected between terminal 2 on switch P4 and terminal 4 on switch P5.

2. Remove the black wire connected from terminal 2 on switch P3 to terminal 4 on switch P4.

3. Connect and solder a wire from terminal 4 on switch P5 to terminal 2 on switch P3.

4. Remove the black wire connected between terminal 2 on switch P5 and terminal 4 on switch P1.

5. Disconnect the orange wire from terminal 4 on switch P3 and solder it to terminal 4 on switch P1.

6. Connect and solder one end of a wire to terminal 4 on switch P4. Connect but do not solder the other end of the wire to terminal 4 on switch P3.

7. Connect and solder one end of a wire to terminal 4 on switch P3. Connect but do not solder the other end of the wire to terminal 2 on switch P2.

8. Disconnect the end of the 10K, 1/2 watt, 5% resistor from terminal 5 on switch P3.

9. Connect and solder one end of a 300 ohm, 1/2 watt, 5% resistor to terminal 5 on switch P3.

10. Connect and solder the cathode end of a silicon diode to terminal 2 on switch P2. Use a Semtech SS2 diode.

11. Join the anode end of the diode with the free ends of the 10K resistor and the 300 ohm resistor and solder.

Having carefully completed the preceding steps, once again test the 6X4 which read full scale prior to the circuit change. Use the same settings as before. The tube should now read between 80% and 90% of full scale.

NSK/JDF/mrs

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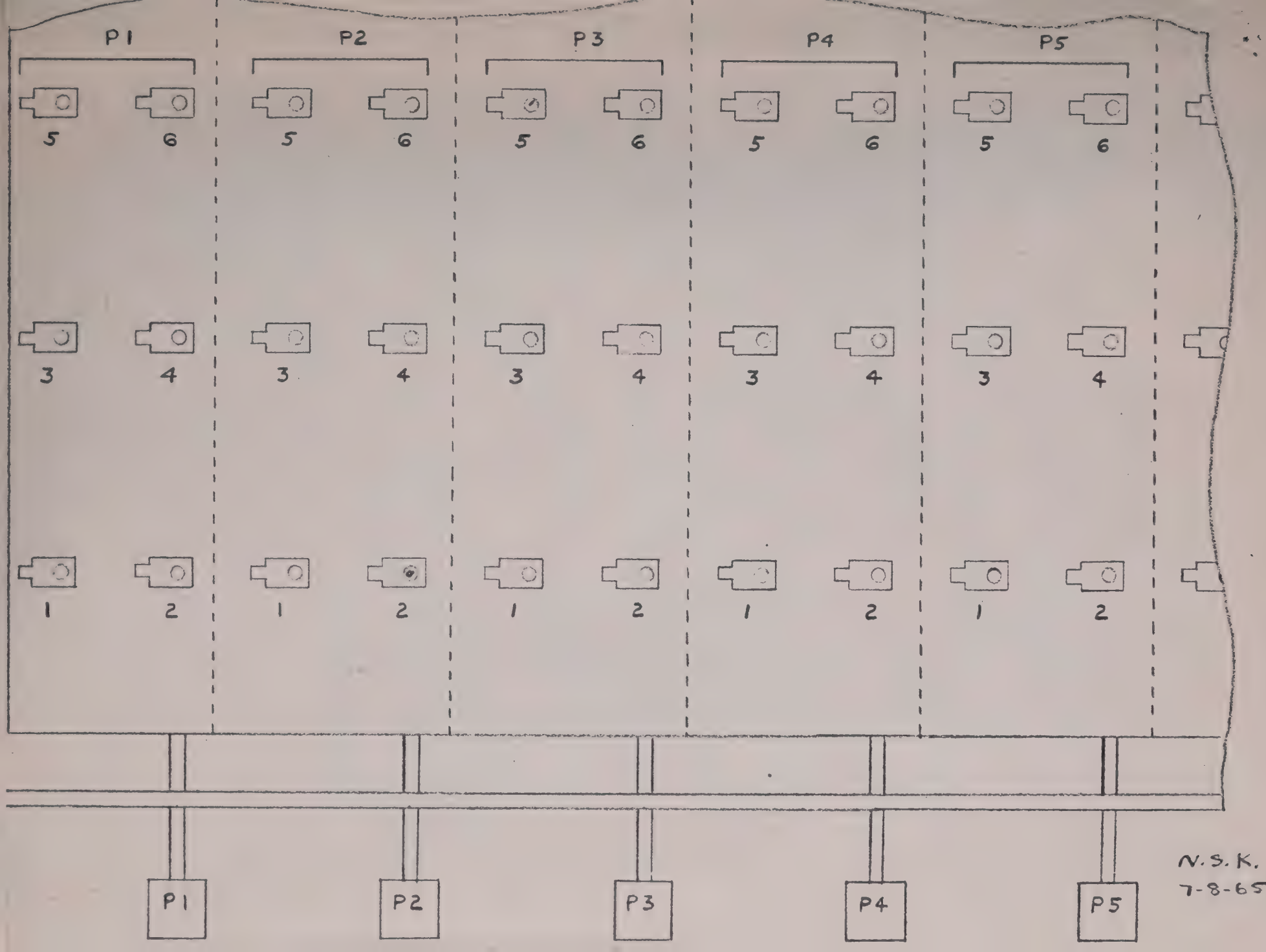
P1
P2
P3
P4
P5
5
6
3
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1
2
P1
P2
P3
P4
P5
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799 MODIFICATIONS

The following modifications are suggested to the Model 799 Tube Tester to eliminate field complaints pertaining to:

A. Poor Rectifier Test

B. Diodes slamming meter to Full Scale

C. High readings on many tubes

D. Poor gas test and leakage test

Modifications consist of:

A. Removal of present meter scale and installation of meter scale supplied.

B. Rewiring of Push-Button switch assembly and installing clamping circuit as per attached instruction.

C. Recalibration of tester as per attached instructions.

The suggested method of modification is as follows:

1. Remove tester from case
2. Remove meter from tester
3. Remove present scale from meter and install scale supplied. Care must be exercised in doing this, so as to not damage meter pointer or meter movement.
4. Remove screws and spacers holding push-button switch assembly to panel assembly.
5. Remove leakage switch from panel.
6. Fold back Leakage switch and Push-Button switch from panel for ease of wiring Push-Button switch.

7. Rewire Push-button switch per attached instructions - exercising extreme care so as not to burn present wiring.

8. Install leakage switch and Push-button Switch to panel.

9. Install meter with new scale.

10. Recheck all calibration, reset signal level from 2.5 volts to 2.0 volts, using a high impedence V.T.V.M for measuring signal. Recheck bridge balance and readjust, if necessary, as per calibration instructions.

New Value

11. Check all cable routing so as to not intangle in Push-Button switch or Line Potentiometer.

12. Check several tube types for normal readings as per Labora Data-book. (2490-516A)

The modifications should require no more than 1.5 hours per unit after location of components is established.

A record of all units modified must be kept at the factory thereafter. Serial Number of all units modified must be returned to the Cleveland Service Department.

C. E. Lenke

CEL:hm

August 1965

PARTS LIST

Reference designations are assigned to identify all parts of the Model 799 Dynamic Mutual Conductance Tube Tester. These designations are used in the parts list and the schematic wiring diagram. The letter prefix of a reference designation indicates the kind of part - resistor, capacitor, electron tube, etc. The number differentiates between parts of the same group.

REF. DESIG.	NOTES	NAME AND DESCRIPTION	HICKOK PART NO.	PRICE EACH
C1		CAPACITOR, FIXED, ELECTROLYTIC: 1000 μf, 6 volts, tubular	3085-101	1.54
C2		CAPACITOR, FIXED, ELECTROLYTIC: 100 μf, 150 volts, tubular	3085-224	1.54
C3		CAPACITOR, FIXED, MYLAR: .018 μf, 5%, 200 volts	3090-206	1.55
C4		CAPACITOR, FIXED, MYLAR: .56 μf, 5%, 400 volts	3090-434	.73
CR1		SEMI-CONDUCTOR DEVICE, DIODE: SS2, 200 PIV	3870-146	1.50
CR2		Same as CR1		
CR3		SEMI-CONDUCTOR DEVICE, DIODE: SS6, 600 PIV	3870-145	3.60
CR4		Same as CR3		
CR5		Same as CR3		
CR6		Same as CR3		
CR7		Same as CR1		
F1		LAMP: #81, bayonet type	12270-2	.20
Q1		TRANSISTOR: 2N3242	20861-63	1.92
R1		RHEOSTAT: 500 ohms, 10%, 25 watt	18750-38	4.11
R2		RESISTOR, VARIABLE: composition, 1000 ohms, 10%, 1/2 watt, snap-in type	40500-102	.51
R3		RESISTOR, VARIABLE: composition, 2K ohms, 10%, 1/2 watt, snap-in type	16925-280	.36
R4		RESISTOR, VARIABLE: composition, 100 ohms, 10% 1/2 watt, snap-in type	40500-101	.90
R5		Same as R3		
R6		RESISTOR, VARIABLE: composition, 100K ohms, 10%, 1/2 watt, snap-in type	40500-104	1.28
R7		RESISTOR, VARIABLE: composition, 3K ohms, 3 watt	16925-529	2.25
R8		POTENTIOMETER: adjusted, 3000 ohms	16926-5	8.95
R9		Same as R3		

REF. DESIG.	NOTES	NAME AND DESCRIPTION	HICKOK PART NO.	PRICE EACH
R10		RESISTOR, FIXED, COMPOSITION: 9.1K ohms, 5%, 1/2 watt	18412-911	.13
R11		RESISTOR, FIXED, FILM: 953 ohms, 1%, 1/2 watt	18694-291	.90
R12		RESISTOR, FIXED, FILM: 237 ohms, 1%, 1/2 watt	18694-233	.90
R13		RESISTOR, FIXED, FILM: 162 ohms, 1%, 1/2 watt	18694-217	.90
R14		Same as R13		
R15		RESISTOR: 100 ohms, 10%, 10 watt, vitreous enamel, center tapped	18575-19	.57
R16		RESISTOR, FIXED, COMPOSITION: 10K ohms, 5%, 1/2 watt	18413-101	.08
R17		RESISTOR, FIXED, COMPOSITION: 47K ohms, 10%, 1/2 watt	18413-472	.13
R18		RESISTOR, FIXED, COMPOSITION: 3K ohms, 5%, 2 watt	18432-301	.24
R19		RESISTOR, FIXED, COMPOSITION: 390K ohms, 10%, 1/2 watt	18414-392	.13
R20		RESISTOR, FIXED, COMPOSITION: 56K ohms, 5%, 1/2 watt	18413-561	.13
R21		RESISTOR, FIXED, COMPOSITION: 82K ohms, 5%, 1/2 watt	18413-821	.13
R22		RESISTOR, FIXED, COMPOSITION: 10K ohms, 10%, 1 watt	18423-102	.13
R23		RESISTOR, FIXED, COMPOSITION: 39K ohms, 10%, 1/2 watt	18413-392	.13
R24		RESISTOR, FIXED, COMPOSITION: 100K ohms, 10%, 1/2 watt	18414-102	.13
R25		RESISTOR, FIXED: 2250 ohms, 5%, 10 watt	18575-418	1.45
R26		RESISTOR, FIXED, COMPOSITION: 300 ohms, 5%, 1/2 watt	18411-301	.72
R27		RESISTOR, FIXED, COMPOSITION: 30 ohms, 5%, 2 watt	18430-301	.96
R28		RESISTOR, FIXED, WIRE WOUND: 150 ohms, 5%, 5 watt	18575-490	1.65
S1		SWITCH, ROTARY: 2 section, 6 pole, 3 position	19912-568	3.75
S2		SWITCH, ROTARY: 2 section, 6 position	19912-580	6.00
S3		SWITCH, ROTARY: 1 section, 2 pole, 20 position	19912-338	6.50
S4		SWITCH, PUSH: 6 button gang, non-shorting	19910-176	9.00
T1		TRANSFORMER: power	20800-327	24.00
X1		SOCKET: 8 pin, octal	19350-435	.75

REF. DESIG.	NOTES	NAME AND DESCRIPTION	HICKOK PART NO.	PRICE EACH
X2		SOCKET: 12 pin	19350-365	.18
X3		SOCKET: 9 pin, novar	19350-367	.18
X4		SOCKET: 9 pin	19350-192	.18
X5		Same as X4		
X6		Same as X4		
X7		SOCKET: 10 pin	19350-434	.25
X8		SOCKET: 7 pin miniature	19350-136	.18
X9		Same as X8		
X10		Same as X8		
X11		Same as X8		
X12		Same as X1		
X13		Same as X1		
X14		Same as X2		
X15		Same as X3		
X16		Same as X4		
X17		Same as X4		
X18		Same as X4		
X19		Same as X4		
X20		Same as X8		
X21		Same as X8		
X22		Same as X8		
X23		Same as X1		
X24		Same as X2		
X25		Same as X3		
X26		Same as X4		
X27		Same as X4		
X28		Same as X4		
X29		SOCKET: 7 pin, nuvistor	19350-382	.18
X30		Same as X1		
X31		Same as X2		
X32		Same as X2		
X33		Same as X2		
X34		Same as X4		

REF. DESIG.	NOTES	NAME AND DESCRIPTION	HICKOK PART NO.	PRICE EACH
X35		Same as X4		
X36		Same as X4		
X37		SOCKET: 10 pin	19350-364	.18
X38		Same as X8		
X39		SOCKET: nuvistor, triode	19350-336	.20
		BUTTON: molded, push, black	2920-7	.10
		BUTTON: molded, push, red	2920-8	.10
		BOOKLET: Tube Data	2490-534	4.00
		CORD: AC line, grey	3675-42	.70
		KNOB ASSY: with pointer, bar type	11500-11	.14
		LEAD ASSEMBLY	12450-400	1.20
		METER	660-158	11.58
		PIN STRAIGHTENER: 7 pin, styrene, black	16277-6	.25
		PIN STRAIGHTENER: 9 pin, styrene, black	16277-7	.25
		SOCKET: Bayonet, for #81 lamp	19350-1	.35
		BOOKLET: Instruction	2490-533	2.25
		CASE: Portable	3145-667	11.00

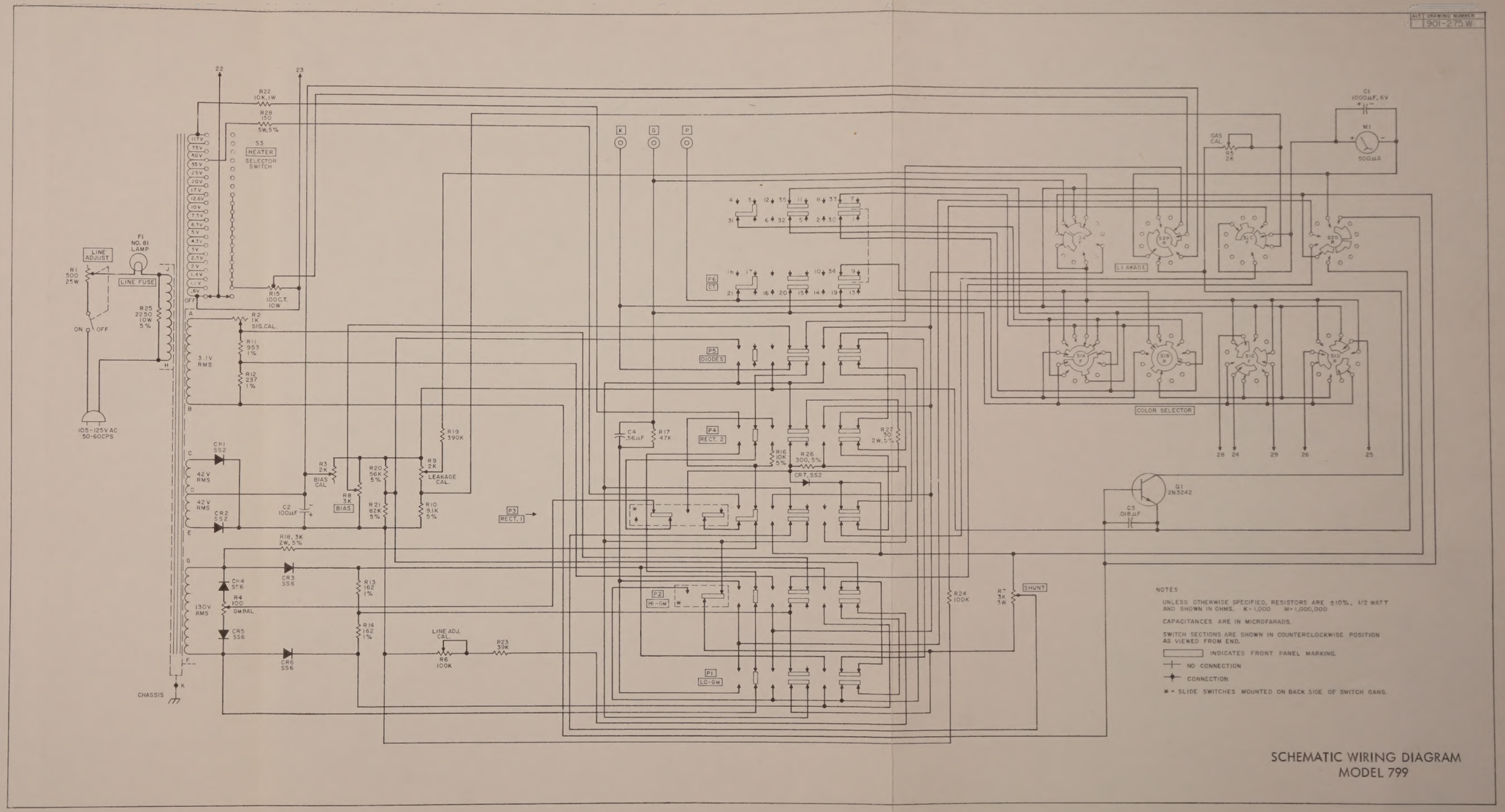
ALT. DRAWING NUMBER
1901-275-W

SOCKET WIRING

(EXAMPLE: 3-6 = SOCKET 3, PIN 6)

WIRE NO 1	WIRE NO 5	WIRE NO 9 (CONT)	WIRE NO 14	WIRE NO 18 (CONT)	20-3	WIRE NO 23 (CONT)	WIRE NO 35
3-6	2-2	29-7	17-3	34-9	21-3	32-12	21-5
5-9	5-3		32-4	36-6	22-1	33-12	28-1
10-1	5-6	32-9	36-3	WIRE NO 19	23-2	34-5	
12-6	7-3	35-9	37-10	2-9	24-1	35-2	
13-7	9-2	37-6	WIRE NO 15	3-3	25-1	36-5	
20-6	15-9	39-8	2-10	4-7	26-4	37-5	
22-3	16-7	WIRE NO 10	4-2	10-2	27-4	38-4	
23-6	20-5	2-4	8-2	16-3	28-4	39-12	
24-5	22-6	15-3	9-6	16-9	29-10	WIRE NO 24	
25-9	24-6	32-2	11-1	18-9	30-7	7-1	
29-1	24-11	35-4	14-11	19-1	31-1	14-3	
32-10	27-7	WIRE NO 11	18-7	19-6	32-1	WIRE NO 25	
33-3	28-8	5-2	26-2	23-1	33-1	3-1	
35-7	29-4	6-1	WIRE NO 16	27-3	34-4	3-9	
38-5	32-8	6-6	16-8	28-7	35-1	6-7	
WIRE NO 2	39-4	8-7	18-2	30-6	36-4	12-8	
15-7	WIRE NO 6	9-5	33-9	33-8	37-4	WIRE NO 26	
16-1	2-8	11-7	WIRE NO 17	WIRE NO 20	38-3	22-4	
27-1	7-10	14-10	1-4	17-8	39-10	31-6	
31-8	15-2	15-1	1-5	19-7	WIRE NO 23	WIRE NO 28	
31-11	18-3	21-6	3-7	28-2	1-8	14-9	
35-6	27-2	26-1	5-8	30-1	2-12	17-7	
37-2	32-3	27-9	8-5	30-4	3-5	28-3	
WIRE NO 3	37-1	33-7	9-7	34-2	4-5	31-4	
2-11	WIRE NO 7	36-9	11-5	34-6	5-5	37-8	
3-8	6-2	38-1	11-6	WIRE NO 21	6-5	37-9	
4-3	10-5	38-6	12-4	4-6	7-6	WIRE NO 29	
5-1	20-2	WIRE NO 12	16-6	14-4	8-4	3-2	
6-3	29-6	2-7	17-6	36-1	9-4	12-5	
9-1	31-3	14-5	18-6	36-7	10-4	WIRE NO 30	
12-1	33-4	14-8	19-8	WIRE NO 22	11-4	7-8	
14-2	35-8	17-1	22-2	1-1	12-7	19-2	
15-8	36-8	30-3	23-3	1-2	13-3	28-6	
20-7	37-7	32-5	23-4	1-7	14-12	34-3	
24-2	38-2	33-10	24-7	2-1	15-5	36-2	
29-2	WIRE NO 8	WIRE NO 13	26-7	3-4	16-5	WIRE NO 31	
32-11	2-3	5-7	26-8	4-4	17-5	1-3	
33-6	14-7	6-9	27-6	5-4	18-5	7-7	
39-2	35-5	7-2	30-5	6-4	19-5	21-7	
WIRE NO 4	WIRE NO 9	8-1	33-2	7-5	20-4	31-9	
1-6	4-1	11-2	34-8	8-3	21-4	32-7	
2-5	4-9	12-3	38-7	9-3	22-7	WIRE NO 33	
4-8	6-8		WIRE NO 18	10-3	23-7	23-5	
13-5	7-4	24-4	7-9	11-3	24-12	WIRE NO 34	
15-6	18-8	24-10	10-6	12-2	25-3	10-7	
17-2	19-9	26-3	14-6	13-1	26-5	17-9	
25-5	20-1	27-8	18-1	14-1	27-5	31-2	
32-6	21-1	31-7	19-3	15-4	28-5	31-5	
37-3	23-8		21-2	16-4	29-12	33-5	
	24-8		30-2	17-4	30-8	34-1	
	26-9		31-10	18-4	31-12	34-7	
	28-9		33-11	19-4			

NOTE:
WIRE 27 AND 32 NOT USED



NOTES

UNLESS OTHERWISE SPECIFIED, RESISTORS ARE ±10%, 1/2 WATT AND SHOWN IN OHMS. K=1,000 M=1,000,000

CAPACITANCES ARE IN MICROFARADS.

SWITCH SECTIONS ARE SHOWN IN COUNTERCLOCKWISE POSITION AS VIEWED FROM END.

▭ INDICATES FRONT PANEL MARKING.

NO CONNECTION

CONNECTION

* = SLIDE SWITCHES MOUNTED ON BACK SIDE OF SWITCH GANG.

SCHEMATIC WIRING DIAGRAM
MODEL 799